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10/525,045

02/18/2005

Shigeki Sakai

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09/07/2006

EXAMINER

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WASHINGTON, DC 20004

ART UNIT

PAPER NUMBER

2813

DATE MAILED: 09/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/525,045

Applicant(s)

SAKAI, SHIGEKI

Examiner

Monica D. Harrison

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 February 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 February 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 9 and 14-17 are rejected under 35 U.S.C. 102(b) as being anticipated by Zhang et al (6,441,417 B1).

2. Regarding claim 1, Zhang et al discloses a semiconductor-ferroelectric storage device, which comprises a transistor (Figure 6, reference 30) comprising a semiconductor substrate or semiconductor region (Figure 6, reference 32) having a source region (Figure 6, reference 34) and a drain region (Figure 6, reference 36) and, on which an insulator buffer layer (Figure 6, reference 38), a ferroelectric film (Figure 6, reference 40), and a gate electrode (Figure 6, reference 42) are layered in this order (Figure 6), wherein the insulator buffer layer is an insulating film comprising a hafnium-aluminum oxide as a main component (column 3, lines 40-47, *Hf-Al-O*).

3. Regarding claim 9, Zhang et al discloses a process for producing a semiconductor-ferroelectric storage device, which comprises a transistor (Figure 6, reference 30) comprising a semiconductor substrate or semiconductor region (Figure 6, reference 32) having a

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source region (Figure 6, reference 34) and a drain region (Figure 6, reference 36) and, on which an insulator buffer layer comprising a hafnium-aluminum oxide as a main component (Figure 6, reference 38; column 3, lines 40-47), a ferroelectric film (Figure 6, reference 40), and a gate electrode (Figure 6, reference 42) are layered in this order (Figure 6), said process comprising a treatment of a semiconductor surface, a formation of the insulator buffer layer, a formation of the ferroelectric film, a formation of the gate electrode, and a heat treatment (Figure 7; column 3, lines 64-67 thru column 4, lines 1-13; *anneal*).

4. Regarding claim 14, Zhang et al discloses wherein hafnium and aluminum are simultaneously supplied to form the insulator buffer layer by vapor deposition (column 4, lines 1-4).

5. Regarding claim 15, Zhang et al discloses wherein hafnium and aluminum are supplied from separate sources (column 3, lines 42-47).

6. Regarding claim 16, Zhang et al discloses wherein hafnium and aluminum are each alternately supplied at least one time to form the insulator buffer layer by vapor deposition (column 4, lines 1-4).

7. Regarding claim 17, Zhang et al discloses wherein the hafnium is supplied first (column 3, lines 40-47).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al (6,441,417 B1) in view of Selbrede et al (US 2004/0025787 A1).

8. Zhang et al discloses all above claimed subject matter except the ratio of aluminum and hafnium (claim 2), nitrogen element (claims 3 and 4) and an oxide, nitride, or oxynitride film (claim 5).

Selbrede et al discloses the ratio of aluminum and hafnium (pg.3, paragraph 0035), nitrogen element (pg.3, paragraph 0035) and an oxide, nitride, or oxynitride film (pg.3, paragraph 0035).

It is obvious, at the time the invention was made, for one having ordinary skill in the art, to modify Zhang et al, with the teachings of Selbrede et al, for the purpose of depositing a film on a substrate.

Claims 6-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al (6,441,417 B1) in view of Selbrede et al (US 2004/0025787 A1).

9. Regarding claim 6, Zhang et al discloses a semiconductor-ferroelectric storage device, which comprises a transistor (Figure 6, reference 30) comprising a semiconductor substrate or semiconductor region (Figure 6, reference 32) having a source region (Figure 6, reference 34) and a drain region (Figure 6, reference 36) and, on which an insulator buffer layer (Figure 6, reference 38), a ferroelectric film (Figure 6, reference 40), and a gate electrode (Figure 6, reference 42) are layered in this order (Figure 6), wherein the insulator buffer layer is an insulating film comprising a hafnium oxide as a main component (Figure 6, reference 38; column 3, lines 40-47). However, Zhang et al does not disclose a nitrogen element as an additive (claims 6 and 7) nor an oxide, nitride, or oxynitride film (claim 8).

Selbrede et al discloses a nitrogen element as an additive (pg.3, paragraph 0035) and an oxide, nitride, or oxynitride film (pg.3, paragraph 0035).

It is obvious, at the time the invention was made, for one having ordinary skill in the art, to modify Zhang et al, with the teachings of Selbrede et al, for the purpose of depositing a film on a substrate.

Claims 10-13 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al (6,441,417 B1) in view of Selbrede et al (US 2004/0025787 A1).

10. Zhang et al discloses all of the above mentioned independent claims 1 and 9 however, Zhang et al does not disclose the atmosphere comprising nitrogen gas (claim 10), the mixed molar ratio of oxygen and nitrogen gas (claim 11), vacuum vessel (claims 12, 13 and 18), nor the pulsed laser deposition (claim 13).

Selbrede et al discloses the atmosphere comprising nitrogen gas (pg.2, paragraph 0014), the mixed molar ratio of oxygen and nitrogen gas (pg.2, paragraph 0014), vacuum vessel (pg.2, paragraph 0016), nor the pulsed laser deposition (pg.4, paragraph 0041).

It is obvious, at the time the invention was made, for one having ordinary skill in the art, to modify Zhang et al, with the teachings of Selbrede et al, for the purpose of using a vacuum vessel in order to treat the substrates with precursor gases, heat the gas, and deposit thin films on the substrate.

Claims 19-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al (6,441,417 B1) in view of Selbrede et al (US 2004/0025787 A1).

11. Regarding claim 19, Zhang et al discloses a process for producing a semiconductor-ferroelectric storage device, which comprises a transistor (Figure 6, reference 30)

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comprising a semiconductor substrate or semiconductor region (Figure 6, reference 32) having a source region (Figure 6, reference 34) and a drain region (Figure 6, reference 36) and, on which an insulator buffer layer comprising a hafnium oxide as a main component (Figure 6, reference 38), a ferroelectric film (Figure 6, reference 40), and a gate electrode (Figure 6, reference 42) are layered in this order (Figure 6), said process comprising a treatment of a semiconductor surface, a formation of the insulator buffer layer, a formation of the ferroelectric film, a formation of the gate electrode, and a heat treatment (Figure 7; column 3, lines 64-67 thru column 4, lines 1-13). However, Zhang et al does not disclose wherein the formation of the insulator buffer layer is conducted in an atmosphere comprising nitrogen gas (claim 19), mixed molar ratio of oxygen and nitrogen gas (claim 20), vacuum vessel (claims 21-23), nor the pulsed laser deposition (claim 22).

Selbrede et al discloses wherein the formation of the insulator buffer layer is conducted in an atmosphere comprising nitrogen gas (pg.2, paragraph 0014), the mixed molar ratio of oxygen and nitrogen gas (pg.2, paragraph 0014), vacuum vessel (pg.2, paragraph 0016), nor the pulsed laser deposition (pg.4, paragraph 0041).

It is obvious, at the time the invention was made, for one having ordinary skill in the art, to modify Zhang et al, with the teachings of Selbrede et al, for the purpose of using a vacuum vessel in order to treat the substrates with precursor gases, heat the gas, and deposit thin films on the substrate.

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Conclusion

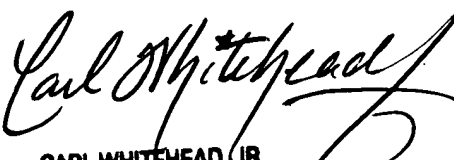
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica D. Harrison whose telephone number is 571-272-1959. The examiner can normally be reached on M-F 7:00am-3:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Monica D. Harrison
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mdh
September 1, 2006


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